

PATHWAYS

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ANANDA-BHARATI

—An Experiment in Non-formal Education

(Janaki N. Iyer, a teacher with several years experience in the formal school system, and her friend, Bhagyalakshmi, describe how they responded to the educational needs of the less affluent, out-of-school learners of a suburb of Secunderabad. The practical problems of the students, the methods of teaching and how they have to be adapted to suit the circumstances make an interesting account.)

The Beginning :

Bhagyalakshmi and I visited the hutments near the neighbourhood of Tarnaka, where we live, and some houses in Shantinagar where the domestic part-time maids of Tarnaka live. Whenever we mentioned the idea of our classes at the Y.M.C.A. Tarnaka branch, our prospective pupils greeted it with a shy approving smile. Most of these girls are the eldest daughters who have not been sent to school because they have to look after their homes and their siblings. Most often the younger ones are sent to school. It is no wonder, therefore, that these girls welcomed the idea of our classes. Two girls from a Muslim family were very enthusiastic; so was their mother. But, when we went there after a week,

they had moved away and we had no way of finding out where they had gone.

"Ananda Bharati" started functioning on the 26th of June 1989, supported by contributions from well wishers. We work from 2 to 4.30 p.m., five days a week. We had four girls on the first day, Bharati and Vedavati around thirteen years of age, Nagamani twelve and Nagendra, nine. After a week Bharati and Vedavati dropped out. Their homes are in Shantinagar, about two kilometres from Tarnaka and there is no public transport available. Bharati is the eldest of four children. She gets the rest ready for school, sends them off and then looks after her youngest brother. After a lot of questioning, I have found out that Bharati's mother finds it convenient to have Bharati at home, especially when she gets back after hours of back-breaking toil. I have not given up and am still in the process of persuading the mother and daughter to let her come back.

There is construction work going on close to the Y.M.C.A. One day I found a few children playing near the building. I asked them if they'd be interested in coming to learn. As always,

the answer was an emphatic 'yes'. Two girls Bhagya, aged about eight and Roothamma aged six joined 'Ananda Bharati', after we met Bhagya's father and Roothamma's mother. Now once again we had a strength of four. Soon Bhagya was pleading with us to let her younger sister join. Swarna, Bhagya's sister was coming back with her mother and her newborn sister. For a month both Bhagya and Swarna came regularly. Then all of a sudden Bhagya stopped coming. When we went to enquire, we found that the mother had started working and Bhagya was required to babysit. We went once again to Bhagya's father armed with her notebooks. He was pleasantly surprised to see all the work done by his daughter and agreed to send her. We told him that we had short hours only to help such children. He agreed to stay back in the afternoon in order to send her but this did not work for long and Bhagya stayed back once again. We found a solution, though not a satisfactory one. Swarna comes to class at 2 o' clock and leaves at 3 pm, Bhagya comes at 3 o' clock and leaves at 4.30 pm. Bhagya, the older of the two, devised these timings and if we could see her clever way of getting to stay for games which are after 4.15 pm., we turned a blind eye to her 'scheming'. As mentioned, this arrangement is not entirely satisfactory. Swarna has to leave at three; she misses the music, the games and often has no time for drawing which she loves. Bhagya arrives when the rest have worked for an hour and are ready for activities, drawing and singing. Arranging activities for all four of them becomes difficult as Bhagya has to give up her language and number work. She is a child who hates to give up anything and loves to participate in activities. We were so bothered by these problems that we thought we could have the baby too in the room but this proposal met with stiff resistance from the parents. The danger that Bhagya will be required to stay at home and not be spared even for two and a half hours is ever-present and hangs over us.

In July, I met a mother and daughter team of domestic workers. Mani, the daughter, joined our classes. She began with sorting, leaves, stones and shells. She began number work and Telugu. Now she has gone away to her village and we do not know if they are planning to get back. Another girl, Vijayalakshmi, joined us around this time. She made rapid progress as she knew the Telugu alphabet and numbers. She worked in a few houses in the morning and came to us in the afternoon. Soon she was able to write her own stories and she made up an interesting one about her name which Bhagya-lakshmi illustrated. Unfortunately for her and for us, Vijaya's mother fell ill and Vijaya had to do her work. Whenever I met her on the road she used to tell me how hard she was working. Now she is out of town and we do not know if and when they'll return. Roothamma is away visiting her sick sister in another town or village. She left suddenly, but remembered to send us frantic messages of how sorry she was to go away for an indefinite period of time. As I write, we hope she is coming back in two days.

The last girl to join us is Varalakshmi. Varalakshmi's mother is an *ayah* in an English medium school nearby. Varalakshmi is more city-based than the others. She is older too, being around fourteen.

Now we have a strength of six. Nagendra and Nagamani were away for a month in August when their families went back to their village.

Rajeshwari, a girl around eight or nine, was with us briefly. She had been to school earlier and could write from 1 to 100, and all the letters of the alphabet. However she did not know what she was writing. So we gave her exercises to build up the concept of numbers. We kept her with numbers from 1 to 5. This plus the fact that we do not set any work to be done at home made her feel that there is no point in coming to us. Rajeshwari is not hard up for money even though her mother is a domestic

servant. Her attitude is quite different from the others. For example she is the only one who asked the price of the kaleidoscope which they were using. She also asked if I could get her one if she paid for it.

The Method of Teaching :

As the account given above shows the children have to be taught individually. This is not at all difficult as there are two of us. Each child has been able to set her own place. Story telling, reading and dramatisation are done in groups. Once a week all of them come together to put up a puppet play using hand puppets.

Drawing is an activity which all of them love. At every available opportunity the children love using crayons and pencils to express their ideas and observations through little drawings. They illustrated their sentences, drew pictures of what they could smell with their noses, of the designs they saw in a kaleidoscope, of Deepavali, of what they saw on election day, of the people in their lives — teacher, TV repairer, the maker of bricks, the potter and the hotel keeper. Story time too provided several opportunities for drawing.



The bees and the flower

The beginners start with sorting exercises using leaves, stones, and other objects. Then they use a cube with dots marked on its faces. They use it like a dice. They put down the same number of seeds as the dots on the face that is up. They circle these seeds. Then they draw this on paper and link all the twos, threes, fours and fives. After several such exercises they learn to write the number, also its name. When addition and subtraction are begun they begin with objects, tamarind seeds, and finally to numbers. Tamarind seeds come in very handy for two more activities. Each child is given a number of seeds, say five or six. She arranges the six seeds in as many ways as she can and draws the arrangements in her note book. Secondly number facts are also discovered by using the seeds. They start with small numbers and then go on to larger ones. For example if six is the number they take six seeds. By dividing them into two groups they find out which two numbers can be added to form six. Then they write the facts down.

For tens and units we used bundles of ten matchsticks each. When the bundles and sticks were put down by the teacher, they wrote the number down. Four of the girls are now doing addition with carrying over and three of them are doing subtraction with borrowing. Roothamma and Swarna know only upto six.

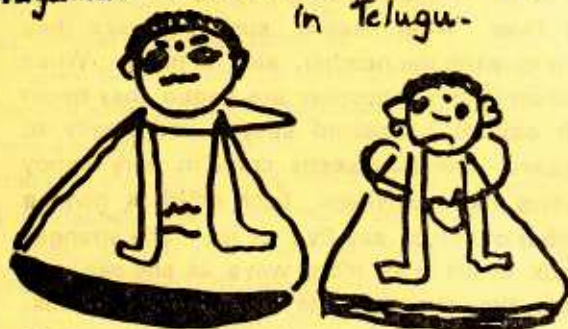
They have also enjoyed cutting and pasting coloured shapes into different patterns.

Language :

For language work the children use cards which they pair and match. When they have learnt two or three letters they enjoy going through a newspaper and circling the letters they know. They do not learn individual letters but words with pictures attached to them. Varalakshmi and Nagamani are able to write now. They have written on some greeting cards given

to them. Bhagya and Nagendramma are a little behind Varalakshmi and Nagamani. Swarna and Roothamma know a few words.

Nagamani illustrated her first sentences in Telugu.



అంజనం అంజనం.

Weather Observation :

In July, all the children maintained a weather chart. They picked their own symbols and put down the symbols after observing the weather everyday. As we do not have a room of our own we are not able to put up charts. So the weather chart was done in their note books in little rectangles representing the days with the dates written on them.

Discussions :

The girls love discussions and games connected with things that are familiar with, for example, vegetables. After playing a game where each person names a vegetable that she thought (no names to be repeated) they drew the different vegetables and wrote down their names in Telugu.

The discussion on measurement was very interesting. They were able to mention all the different things which are measured and the various ways of measuring them. They also described a game they play using the hand span

called 'Ja-a' in Telugu and the width of four fingers called 'Betha'. The game is as follows :

A large circle is drawn on the ground with two diameters at right angles to each other. Four split halves of tamarind seeds are thrown on the floor. If all four are upturned then the player moves one span on the circle from the starting point. If the seeds are the other way the player moves a four-finger-width. The one who completes the circle and also goes over the diameters first wins.

On Independence Day, which the children called "Indiramma Panduga" (Indiramma's festival) they enjoyed making the national flag but didn't have the inclination to hear about the freedom movement, even in brief.

A number of action songs and a few number rhymes have been taught by Bhagyalakshmi. These are mainly songs composed by Jai Seetarama Rao and relate to the weather, bees, gardens, colours, workmen etc. Bhagyalakshmi has collected them over a period of time. Since they are in simple Telugu, sung to catchy tunes, the children enjoy them.



Bhagyalakshmi brought back pictures of Kathakali dancers from Kerala. The children drew their own pictures.

(Conti used on page 6)

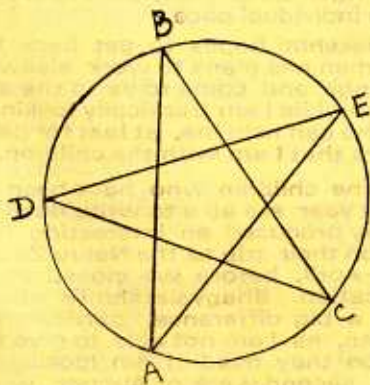
MATH CLUB IDEAS—3

One-minute Non-routine problems

Non-routine problems are those problems which are simpler than simple problems. By virtue of the solution being tackled in a non-routine manner, they look complicated, or at least look as though they require complicated methods to solve. The moment you strike upon the simplicity of approach you would laugh at yourself for being so ignorant.

Each of these problems should not take more than exactly one minute to solve.

1. Find angle ABC in this regular inscribed pentagram.



2. What point is the centre of a circumscribed circle of a right triangle?
3. Make a square with an area of five square units on a grid of 4 x 4.
4. If $\sin x = 3 \cos x$, then what is $\sin x \cos x$? Choose the correct answer.
a) $1/6$ b) $1/5$ c) $2/9$ d) $1/4$ e) $3/10$
5. Which is larger, 2^{30} or 3^{26} ?
6. Find x such that $(123456789) \times x + 9 = 987654321$
7. How many years would have elapsed between 1 January in 10 B.C. and 1 January A.D. 10, if such dates had existed then?

(Continued on page 6)

READING GAMES FOR VERY YOUNG

These two games are suitable for children who are just starting to read.

Spot the Odd Sound Game

Collect together

- 20 pieces of 8cm by 8cm card
- Felt pens.

Make the game

1. Decide on four sounds, e.g. "h", "f", "t", "b". On the small cards, draw five pictures for each sound, e.g.
"h"..... horse house, hat, hen, hand,
"f"..... fish, face, fox, finger, feather.
"t"..... table teapot, teeth, tomato, tiger,
"b"..... bus, bottle, bee, boot, box.
2. On the back of each picture card print the initial sound.

Play the game

Place five of the cards all starting with the same sound, picture side up, in a row. Add a sixth card from another sound group. Ask the child to spot the picture starting with a different sound.

Help the child at first, by slowly saying the names of the objects out loud. The child can later check whether or not he/she has picked the correct picture by looking at the letters printed on the back.

Word Snakes and ladders

Collect together:

- A snakes and ladders board.
- A pack of 20, 6cm by 6cm blank cards.
- A felt pen.
- Some counters or buttons, one per player.

Make the game

Write a word on each of the 20 cards. You may use the same word several times if you like and you may need to add simple pictures to help the children recognise the words. Add a number (from 1 to 5) on the corner of each card.

When playing use the pack of cards instead of a dice. Shuffle the cards and lay the pack face downwards on the table. Each player draws the top card from the pack and the number on the card indicates his next move. The child should attempt to read the word before moving his counter.

Continued from page 4)

The four cardinal directions have been introduced to them. They have learnt their names and how to find them. We have to do more work on this before we start mapping.

Outings :

The outing that the children enjoyed most was our trip to witness the play "Pipileka", dramatised by Poornachandra Rao. It is a musical play in which young farmhands acted as ants which learn to cope with an anthill-grabbing snake. When we came back; we were agreeably surprised to see that the children had not only understood the story and its message, but were also able to remember much of the dialogue and songs. They acted it out again.

We took them to the Public Gardens in Hyderabad. We did some bark and leaf rubbings, but we found such long trips by autorickshaw tired them.

Games :

Everyday we spend 15 or 20 minutes in play. The Telugu version of "Simon says" and "Inside. Outside" are both very popular. The children have become experts at skipping and are also learning to catch and throw a large sized ball.

Sewing :

The girls have taken to sewing with great interest. In fact, after sewing was introduced, puppet plays have not had a chance.

Problems :

The lack of a room of our own has been a problem. The room to us by the YMCA is nice, but we cannot lock it as it is used by others also. So we are unable to put up charts or any work done by the children.

Attendance too worries us. Though the children are extremely keen they are sometimes not able to come to class. Nagendra had to miss three days last week as her mother had rushed to her village to repair her hut which had collapsed in the rains. The children of construction workers will be with us only as long as the construction lasts. Once they move to other sites, they may not be able to come to us.

There is an acute need for a creche. Had there been one, we would have had some more

children who are now required to look after their baby brothers or sisters.

So far, ill-health has not caused any absenteeism except in the case of Swarna. We persuaded her father to take her to a good doctor nearby. Now she is better and regular in attendance.

On the positive side, the children and both of us enjoy our afternoons immensely. The children have a good span of attention and are keen learners. We could do much more if we had more time but that makes all of us value even more, the time that we do have.

November 1989

Postscript :

We re-opened on June 12th and faced our first serious problem. Bhagyalakshmi told us that she wouldn't be able to be with us every afternoon as she has joined a Computer course. This was particularly hard on me as we began the year with fifteen eager, demanding pupils. When five of them dropped out because their homes were far away, I did not call at their homes as I normally do to persuade them to come back. I have nine girls and one boy now, all of them used to working at their own individual pace.

Bhagyalakshmi hopes to get back to us next year when she plans to work elsewhere in the mornings and come to us in the afternoons. Meanwhile I am frantically looking for someone who can help me, at last for part of the $2\frac{1}{2}$ hours that I am with the children.

Four of the children who have been with us since last year are able to write fluently in Telugu. They produced an interesting folder of articles on their trip to the Nehru Zoological Park in April, before we closed for the summer vacation. Bhagyalakshmi's absence does make a big difference, particularly to these children, as I am not able to give them the attention they need. I am looking forward to the second week of August, when a friend, Radha, has promised to join me.

Bhagyalakshmi's decision to equip herself for a job makes me realise that we need to look for funds which will make it possible for me to offer at least a modest remuneration.

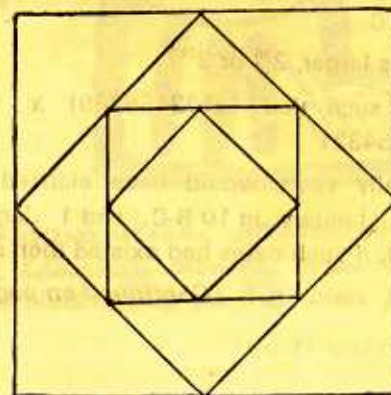
July 1990

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Secunderabad



(Continued from page 5)

8. A 10 unit square has a second square inscribed in it by joining the midpoints of the sides of the first. If this process is continued, find the ratio of the area of the fourth inscribed square to the area of the original square.



—Solutions on page 9

A BAG OF BOOKS FROM THE NBT

1. 1 to 10 PROCESSION ... Mickey Patel
2. FIND THE HALF-CIRCLES ... Badri Narayan
3. BUSY ANTS ... Pulak Biswas
4. DIWALI ... Ravi Paranjpe
5. ANIMAL WORLD ... Aurobindo Kundu
6. OUR USEFUL PLANTS ... K. S. Sekharan
7. THE STORY OF BLOOD ... Rekha and Yatish Agarwal
8. OUR BODY A WONDERFUL MACHINE ... Ramesh Bijlani
Illustrator Niren Sen Gupta
9. WATER ... Rama
10. THE SNAKES AROUND US ... Zai & Rom Whitaker
11. SOME STREET GAMES OF INDIA ... Mulk Raj Anand
12. FESTIVAL OF EID ... Premchand
13. COMMON BIRDS ... Salim Ali and Laeeq Futehally
14. EVERYDAY INDIAN PROCESSED FOODS ... K. T. Achaya
15. LAUGHING TOGETHER ... National Book Trust, India

The first five books listed above are for the very young. There are only pictures in these books except for the short sentences in **Animal World**. Teachers might derive inspiration for pictures of animals from this book. The illustrations could even be enlarged and made into jigsaw puzzles. Mickey Patel's drawings in the counting book, **1 to 10 Procession**, are interesting, very Indian and could be used for initiating conversations. **Find the Half-Circles** is interesting as an exercise in observation even for adults. It shows how little we open our eyes to look at the world around us. Teachers will find **Busy Ants** and **Diwali** useful for picture stories—get children to talk about what is happening on each page.

Our Useful Plants is an easy-to-read booklet for children of the Primary Classes—an introduction to Science and how it is intermingled with our daily lives. I only wish the author could have given the little dog a name other than Tommy! Teachers might need a note to give them the common names of eggplants, okra and marrow.

The Story of Blood, Our Body, Water and **The Snakes Around Us** are good, reading even at Class VI or VII. The mysteries of topics commonly taught in Science Classes are simply explained.

Some Street Games of India by Mulk Raj Anand might form the basis of an exercise in English for the Middle School. It would provide a model for students to write a description of their favourite childhood game. Premchand's story—**Festival of Eid**—translated by Khushwant Singh is a delightful account of the celebrations connected with this important festival—it should be read by students of the middle school as an introduction to Indian Literature.

The last three are useful reference books for school libraries. **Laughing Together** will be of particular interest to language teachers who find themselves tired of European/Western writers.

I picked up these books from a mobile NBT exhibition, the van being chock—a—block full with several other titles, in English as well as other Indian languages. A pity that these books, generally well-produced and quite inexpensive, are not more widely known or better displayed in bookshops. All of them should be available from the National Book Trust, India, A-5, Green Park, New Delhi-110 016. Ask for their catalogue as well. You might consider these books as prizes and classroom reading material.

PUNCTUATION

The purpose of punctuation is two-fold; it supplies the written word with what tone of voice, facial expression and gesture give to the spoken word, and it provides pauses which enable the reader's mind to grasp the meaning of a phrase or sentence.

Its use, therefore, is more of a skilful art than a slavish obedience to rules. However, certain rules must be observed—and these are particularly important for examination English. Outlined below are rules for the use of a comma, one of the most used marks of punctuation.

THE COMMA

The comma has been described as 'the most troublesome of stops'. The tendency to sprinkle commas around like salt on chips must be controlled. If in doubt, omit the comma! It is necessary only in the following.

1. To separate items in a list.

'In my tool kit I have a hammer, saw, chisel, nails, and plane.'

(When the last pair go together by association—hammer and nails, fish and chips, knife and fork, etc., no comma is required before 'and'.)

2. To mark off clauses in a sentence.

'In reply to your letter of the 15th March, I can tell you that ...'

3. To replace brackets.

'Mr. Brown, *our lecturer in Law*, was married last week'.

4. To separate adverbial phrases.

'*Wherever you may go*, you are certain to meet.....'

5. Around adverbial phrases in the middle of a sentence.

'I shall, *however*, hope to see you ...'

'He said that, *owing to the circumstances*, he would ...'

6 To indicate words that are understood.

'The sergeant cried 'Halt!', (*cried*) 'Stand to attention', (*cried*) 'Stand at ease'.'

7. To separate clauses introduced by a relative pronoun.

'My secretary, *who is an excellent organizer*, will arrange.....' but note the difference in meaning between :

'The girl, *who suffered from epilepsy*, took the Minutes.'

and

'The girl *who suffered from epilepsy*, took the Minutes.'

In the second example attention is being drawn to the illness; in the first the illness is incidental and could be omitted.

Many text-books on punctuation explain the above in another way. The clause *underlined* is classified as either 'defining' or 'subordinate'. If it defines the person or thing, as in 'The dog *which had no tail* bit the postman.' It is not separated from the sentence by commas. If it is subordinate, and attention is not focused on the clause, commas are used—e.g. 'The dog *which had no tail*, bit the postman

8. To introduce Direct Speech.

She said 'I wish I were going too'

Longer quotations should be introduced by a colon.

—to be continued

* * *

A KIT FOR IMPROVISED EXPERIMENTS IN CHEMISTRY

Equipment

Glasses

Jam Jars

Plastic Funnels

Clothes clips

Ice cream cups

Tinsids//

Filter paper (muslin cloth)

Small kitchen tongs

Saucers

Plastic Spoons

Drinking straws

Magnet (from toy shop)

Splinters from broom

Sources of heat :

Candle

Kerosene/spirit lamp

Kerosene stove

Water supply

Chemicals (obtained

from the home or a

chemist's shop)

Salt

Sugar

Sand

Milk

Honey

Lime juice

Vinegar

Turmeric (*haldi*)

Soda bicarb

Butter

Sooji (rava)

Peanuts

Beetroot juice

Chuna (fresh from *paanwalla*)

"Surf"/Soap powder

Washing Soda

Potassium permanganate

Hydrogen peroxide

Starch Powder

Iodine (Crystals and

liquid)

Tablets of Vitamin C

Milk of Magnesia (or

any other antacid)

Kerosene

Toilet cleaning acid

Manganese dioxide (Cut

up a used dry cell)

From the Laboratory

Litmus

Phenolphthalein

Magnesium wire

Copper sulphate

Ammonium chloride

Dilute sulphuric acid

Silver nitrate (solution)

Ferric chloride (solution)

Barium chloride (solution)

Given the above materials, see how many improvised experiments you can devise to illustrate the following concepts in Chemistry. In each case figure out what equipment and chemicals you will need, and, keeping the safety factor in mind, whether it is to be a student experiment or a teacher demonstration.

Concepts

1. Solubility of substances.
2. Separation of substances.
3. Sublimation
4. Effervescence
5. Anhydrous/Hydrated Salts
6. Physical and Chemical Reactions (differences)
7. Testing for Gases/other substances
8. a. Properties of Acids
b. Testing for acids, bases
9. Different kinds of chemical reactions
10. Any other concepts?

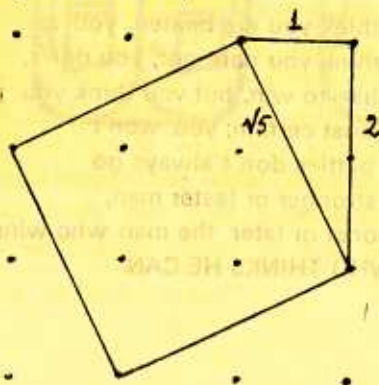
Please also explore possibilities of any other equipment or "chemicals" that may be added to this kit.

Now look at page 12 for some suggested experiments.

ONE-MINUTE NON-ROUTINE PROBLEMS

Solutions

1. If each arc AC, CE, EB, BD, DA were to inscribe an angle at the centre (they are all equal), each angle would be $360 \div 5 = 72^\circ$. Therefore angles at the circumference = 36° (angle at centre is twice angle at the circumference).
2. On the mid point of the hypotenuse (say why?)
3. The figure is self explanatory.



4. If $\sin x = 3 \cos x$, $\tan x = 3$; $\sin x \cdot \cos x = \frac{1}{\sqrt{10}} \cdot \frac{3}{\sqrt{10}} = \frac{3}{10}$
5. $2^{30} = (2^3)^{10}$; $3^{30} = (3^3)^{10}$;
Since $2^3 < 3^3$, $2^{30} < 3^{30}$
6. $(123456789) \times 9 = 987654321$
 $9 + ?$ will give a number ending in 1? The number added to 9 should be one ending in 2. Hence, the number $(123456789) \times 9$ should end in 2. Notice the last digit within the bracket is 9. What number multiplied by 9 gives a product ending in 2? 8. Hence $x=8$.
7. 19 years. Since there is no year, numbered as 0 A.D. or 0 B.C.
8. Fold the corners of a square, to fall on the centre of the square, to form the second square. The ratio of the second to first is 1:2. Therefore the ratio of the fourth to the first is 1:16.

Mrs. Saroja Sundararajan
Madras

DOLLS FROM PLASTIC CONTAINERS

Now-a-days everything is packed in plastic containers. There are a number of such plastic containers of different shapes which can be used for making dolls. We chose 'Parachute Coconut Oil bottles', and asked our students to bring them to school along with different kinds of plastic caps. The students gathered a number of containers and caps. We utilised this opportunity for the craft lesson in the 4th and 5th classes. Now all these dolls are very useful to teach the kindergarten children, especially in story telling.

Materials

- i. Parachute coconut oil bottles.
- ii. Different kinds of caps.
- iii. Small size plastic balls.
- iv. Fevicol
- v. Black wool (for hair)
- vi. Tablet blister packing covers.
- vii. Any round shaped small balls (for eyes)
- viii. Oil paints (for the features).

We can buy small plastic balls for Rs 5/- a dozen. A small container of Fevicol costs Rs. 8/- only and can be used for nearly 100 dolls. Oil paints—a small bottle cost Rs. 6/-. We can buy the basic colours i.e. white, black, red, green, blue, yellow, and can use these paints for nearly 100 dolls. Most of the other things can be got without any expense.

Method

First clean the coconut oil bottles with soap and water. Remove the printed name with thinner or a blade. Apply the Fevicol at the upper rim of the bottle and fix the plastic ball at the mouth of the bottle. It will take 2 to 3 hours to dry and will become the head of the doll. Now the skeleton has been completed. Imagination plays an important role in designing the dolls and different models.

For example, to make a policeman, we have to choose and paint caps just like police caps. After fixing the head fix the cap on it with Fevicol. Use the wool as hair. It is also fixed on with Fevicol. Then paint the face with white paint and body with different kinds of colours. According to the need, clothes like shirts and frocks are painted onto the body. For example, paint khaki colour on the police doll for his shirt and trousers. A black leather belt, buttons, pockets, a red cap complete his costume. The eyes, nose, mouth and moustache are also done with black paint.

If you want to add hands or any other objects in the hands, use polystyrene foam which is used for packing electrical and electronic goods. It can be cut into different shapes and can be pasted on with Fevicol.

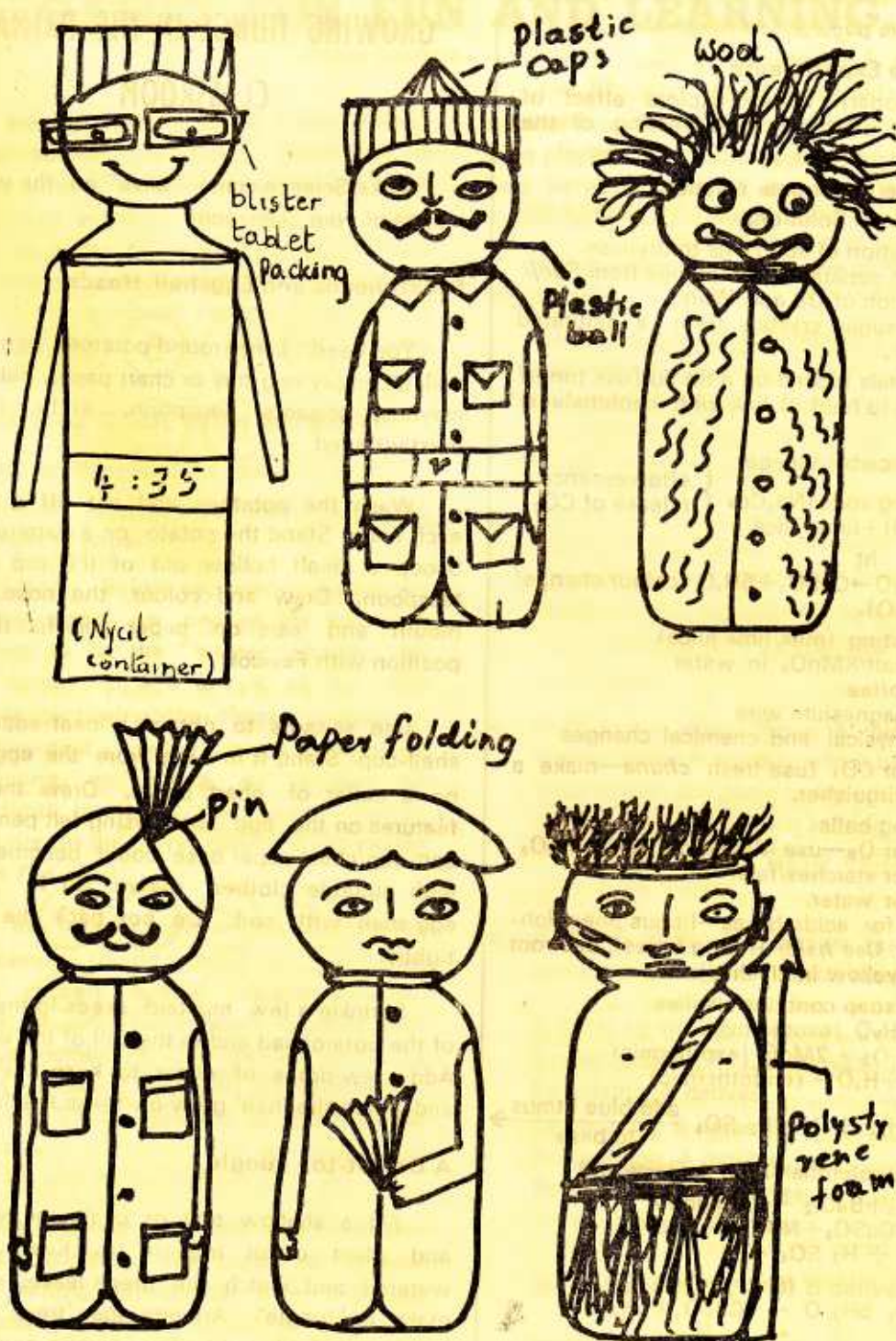
Some of models made in our school are shown in the figure on the opposite page.

Life is

- ...a duty, perform it
- ...a challenge, meet it
- ...a struggle, accept it
- ...a tragedy, face it
- ...an adventure, dare it
- ...a mystery, unfold it
- ...a promise, fulfil it
- ...a journey, complete it

Think

If you think you are beaten, you are,
if you think you dare not, you don't,
If you like to win, but you think you can't
It is almost certain; you won't
Life's battles don't always go
to the stronger or faster man,
But sooner or later the man who wins is the
man WHO THINKS HE CAN.



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Some Possible Experiments

- a) Salt (Sugar)+Water—explore effect of stirring, grain size and heating of the solution.
 - b) Miscible/Immiscible solutions.
- a) Filtration of Solutions.
 - b) Evaporation of solutions to dryness.
 - c) Magnet separates Iron Filings from *Sooji*.
 - d) Separation of Oil and Water.
 - e) Make sugar crystals from a saturated solution.
- Iodine crystals heated on a tin lid (use tongs/ clothesclip to hold it) link with naphthalene/ Odonil.
- a) Soda bicarb + Vinegar
 - b) Washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$) + lime juice

$\left. \begin{array}{l} \text{a) Soda bicarb + Vinegar} \\ \text{b) Washing soda (Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O) + lime juice} \end{array} \right\} \begin{array}{l} \text{effervescence} \\ \text{release of CO}_2 \end{array}$
- $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \xrightarrow{\text{ht}} \text{CuSO}_4 + 5\text{H}_2\text{O}$ (colour change/ test for H_2O).
- Magic writing (milk/lime juice)
 Dissolve salt/ KMnO_4 in water
 Making toffee
 Burning magnesium wire
 Identify physical and chemical changes
- a) Test for CO_2 (use fresh *chuna*—make a fire extinguisher.
 - b) Dancing balls
 - c) Test for O_2 —use MnO_2 (old cell) + H_2O_2
 - d) Test for starches/fats.
 - e) Test for water.
 - f) Tests for acids/bases—litmus/phenolphthalein. Use *haldi* (red in bases); beetroot juice (yellow in alkalies)
 - g) Prove soap contains alkalis
- a) $\text{CaO} + \text{H}_2\text{O}$ (exothermic)
 - b) $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ (exothermic)
 - c) $\text{NH}_4\text{Cl} + \text{H}_2\text{O} \rightarrow$ (endothermic)
 - d) $\text{Ca(OH)}_2 + \text{HCl/H}_2\text{SO}_4 \xrightarrow{\text{add blue litmus to base}} \rightarrow$
 (or phenolphthalein to acid—why?)
 - e) $\text{AgNO}_3 + \text{BaCl}_2 \rightarrow (+\text{light?})$
 - f) $\text{FeCl}_3/\text{CuSO}_4 + \text{NH}_4\text{OH} \rightarrow$
 - g) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow$
 - h) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \xrightarrow[\text{water}]{\text{heat}} \text{CuSO}_4 + 5\text{H}_2\text{O}$

—Gayatri Moorthy

GROWING THINGS IN THE PRIMARY CLASSROOM

Make Science come “alive” on the window ledges of your classroom.

Potatoheads and Eggshell Heads

You need : Large round potatoes, egg shells, soil, an empty egg tray or chart paper, felt pens, crayons, scissors, teaspoon, knife, Fevicol, mustard seed.

Wash the potatoes and cut off a slice at each end. Stand the potato on a flatter end. Scoop a small hollow out of the top using a teaspoon. Draw and colour the nose, eyes, mouth and ears on paper and fix them in position with Fevicol.

Use scissors to obtain a neat-edged egg-shell-cup. Stand it in a cup from the egg-tray or on a collar of chart paper. Draw the facial features on the egg shell using felt pens. The egg-cup/chart paper base could become a body with suitable clothes drawn on it. Fill the egg shell with soil. Do not pack the soil in tightly.

Sprinkle a few mustard seeds in the hollow of the potatohead and in the soil of the eggshell. Add a few drops of water to keep them moist and watch the ‘hair’ grow on these heads.

A Carrot-top Jungle

Fill a shallow tray or container with soil and plant carrot tops in it. Keep the soil watered and watch the green leaves sprout to make a ‘Jungle’. Arrange the ‘trees’ of this jungle artistically, add a few plastic animals and birds and a pond made out of silver paper or a piece of broken mirror.

GAMES FOR FUN AND LEARNING

Here are two games which older children and even adults can enjoy. Skedoodle is deceptively simple. Apart from practising quick manipulation of numbers, one must keep one's wits alert in order to win. Change, Change involves spatial arrangements and an attempt to finish in the minimum number of moves. It can even be played alone whenever one has time to spare.

SKEDOODLE—A GAME WITH NUMBERS

- *Number of Players.* Two, three, or four.
- *Equipment.* A pencil for each player and one sheet of paper.
- *Preliminary.* Before each game the players together agree on one of the following numbers to be the "master number" for that game: 3, 4, 5, 6, 7, 8, or 9. Any number containing the chosen number, or any two-digit number which by adding,

number from the number written by the preceding player. All numbers must be whole numbers between 1 and 30 and may not duplicate a previously used number.

Numbers are derived by one of the following operations:

1. Adding, subtracting, multiplying, or dividing the digits of a two-digit number. (For example, 28 could be used to derive 10 by addition, 6 by subtraction, 16 by multiplication, or 4 by division.)
2. Doubling (as 9 to 18)
3. Halving (as 22 to 11)
4. Squaring (as 4 to 16)
5. Taking the square root (as 16 to 4)
6. From the number 1 any unused number can be derived.

- *Ending the game.* When a player cannot legally derive a number which has not been

By doubling, A derives ... 20
By addition ($2+0$), B derives ... 2
By halving, A derives ... 1
From 1, B chooses to go to ... 15 and
scores
By doubling, A derives ... 30

No unused number can now be derived and B wins the game by a score of 2 to 1.

Change Change

- ☐ *Number of players.* One.
- ☐ *Equipment.* Eleven coins—four of one denomination, four of a second denomination, two of a third denomination, and one of a fourth denomination. (For example—four Re 1, four 10 p, two 5 p and one 25 p).
- ☐ *The play.* Shake the eleven coins together in your hand and then place them on a flat surface arranged in three rows as shown. (The X represents an empty space.)

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O   O   O   O
O   O   O   O
O   O   O   X
    
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The object is to rearrange the coins into a symmetrical position by sliding them one at a time into the empty space (which, of course, is constantly changing its position). Only a coin directly next to the space, not including diagonally, can be moved into it.

A symmetrical position is one which is balanced around the middle row. In other words,

Since there is only one place a moved coin can go, all that is required is to record the starting space.

Let's take a game played with the eleven coins previously mentioned. After mixing them they are put down like this.

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(25) (10) (1) (10)
(1)  (5)  (5) (10)
(1)  (10) (1)  X
    
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The moves are

- | | | | | | |
|------|-------|-------|-------|-------|-------|
| 1. H | 9. F | 17. K | 25. H | 33. I | 41. F |
| 2. D | 10. E | 18. G | 26. L | 34. J | 42. B |
| 3. C | 11. I | 19. C | 27. K | 35. F | 43. A |
| 4. B | 12. J | 20. D | 28. G | 36. B | 44. E |
| 5. F | 13. K | 21. H | 29. F | 37. A | 45. I |
| 6. E | 14. G | 22. L | 30. B | 38. E | 46. J |
| 7. A | 15. F | 23. K | 31. A | 39. I | 47. K |
| 8. B | 16. J | 24. G | 32. E | 40. J | 48. G |

and the symmetrical position is

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(5)  (10) (1) (10)
(1)  (1)  X  (25)
( )  ( )  ( )  ( )
    
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